HOW TO MAKE AND USE MATCH PLATES

By [illegible]

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PREFACE

Owing to the great change that has been made in the method of moulding in the past few years, a great demand has risen for men who can mount various types of patterns for the proper moulding machines, so as to promote rapid production in moulding.

I am a practical man, and not capable of using any term which will not be readily understood by the average working man, and I will endeavor to make my points clear and simple enough so that they may be applied to any class of work. I have simplified the illustration on making an Aluminum Match Plate by using only one pattern, as a complicated mould would be apt to confuse the reader. The principle illustrated in this simple mould may be carried out in the same manner on work which is more complicated.

JUDGMENT IN MAKING EQUIPMENT

IN MY experience, I have found that it requires considerable study to ascertain the very best way to mount various patterns so as to obtain the best results. The average pattern maker and foundry foreman has no experience in this line until a moulding machine is purchased by their firm, after which they receive their instructions from the representative of this moulding machine concern, who in turn instructs them as to the best ways of making their work on his machine, and urges them to put all of their work on this machine regardless of the expense in rigging up these jobs, or of the fact that there may be other machines much more adapted to the work.

The first question which should be asked when considering the cutting of costs on a certain casting, is, what is the prospective number that will be made each year, and will the model be apt to remain the same for any great length of time? Figure the approximate cost of making your equipment, and the probable saving that would be made in moulding costs. If the equipment will pay for itself in a reasonable length of time, then go ahead. I have known of patterns being made up on an Aluminum Match Plate when the firm was only using about one hundred castings of

this type per year, and in all probability the design of this pattern would be changed long before the plate ever paid for itself. This can be readily figured. For example, if you used one hundred castings per year, and a moulder produced these in one day from two loose patterns at a wage of three dollars ($3.00) per day, each casting would cost you three cents for the moulding. If after the job was made on a plate with two patterns on a gate, one hundred and twenty-five moulds or two hundred and fifty castings per day were made, your castings would cost you approximately one and one-fifth cents each, and you would have a total saving of one dollar and eighty cents ($1.80) on your year's business. If your Match Plate cost you twenty dollars ($20.00), it would take about eleven years to pay for the plate, and it is more than likely that the design of the pattern would be changed before that time and the plate discarded. I am merely citing this example to warn you that it is equally as important to use judgment as it is to be able to rig up work.

In the following pages I will endeavor to explain the uses of different types of plates in their proper places.

FIG. I.

Pattern and flask set up on blocks in position for ramming the drag.

PROPER TYPE OF PLATE

Any flat pattern that is all in the drag, or any pattern which can be split on a straight parting line, should never be cast on a plate but should be riveted to the plate, or screwed to a wooden plate. Patterns which are cast on plates, can be cast of aluminum or iron, but aluminum is preferable. There are also compounds used successfully in casting plates by some firms. Before placing patterns on plates, see that they are drafted properly and put in good condition. If the firm demands a casting square and without draft, the pattern should be put on a stripping plate. It is often necessary to make castings on a moulding machine for accuracy as well as to increase the output. Before making your master pattern, decide on the best possible parting line. Some patterns with pockets or deep curves will not cope out without soldiers or extra security when made with the pocket side up, but by moulding pocket side down, you would have no trouble with the cope. In many cases, however, it will be necessary to have these pockets or cores in the cope, in order to have the face or machine side of casting in the drag. After you have decided upon the proper parting line, draft your pattern from this line. On some patterns which

give trouble in the foundry through some straight part or narrow core, it is well to take the matter up with the engineer or draftsman, as oftentimes they can alter the design to help the foundry without indebtiment to the casting. If the pattern is small you will cast a number of them on the plate, and the next step is to decide the proper size snap flask to use. I have always considered that I would get the most efficiency by using a medium sized flask, although foundrymen's ideas differ greatly on this point. After you have decided upon the proper sized flask to use, you will then determine how many patterns can be used in this space. One inch of sand is sufficient for joint in most cases, and the manner in which the patterns are located on the plate will be determined by the best method of gating. Judgment should be used as to how the mould will fill up, and the gate should be arranged so as to prevent the metal from cutting a mould or washing small cores. The surfaces of the castings which are to be machined, should be avoided in gating. Many castings are missrun by the metal not entering the mould in the proper place. In many cases where there are cores which necessitate a passage for gas, it is well to gate casting on opposite end from vent, so as to allow gas to travel

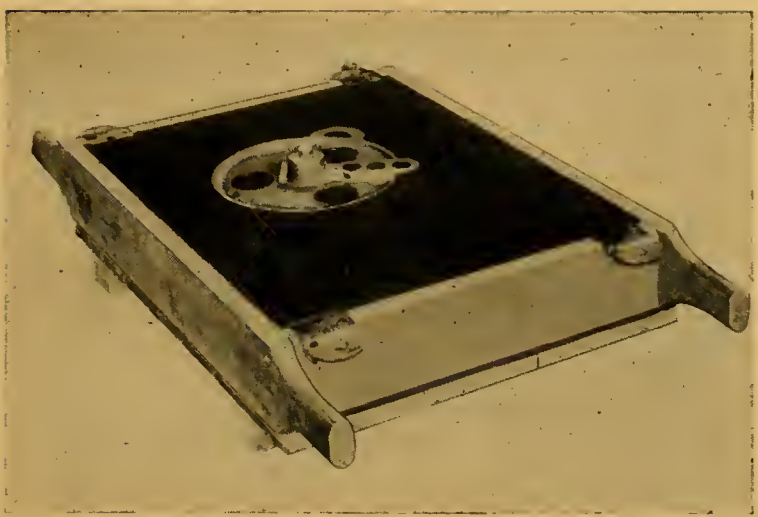


FIG. II.
Drag rolled over and parting made.

in the same direction as the metal. In some cases it is well to have a gate made in wood, so that it can be rammed up in the mould when making the plate, although in most instances the gate can be cut after the patterns are drawn. When you require a number of patterns in making a plate, it is well to cast them of lead or babbitt metal, as this is easily scraped and finished for moulding. In cases where you have a pattern and would like to make a plate from same to save the cost of a new master pattern, it can oftentimes be cut in places and spread to allow the proper shrinkage. Patterns which have heavy sections can be cored out by letting the core cut through in places. These prints should be round, so that the holes can be cleaned out with a drill and plugged. This gives you a plate which is lighter in weight and also overcomes the shrinkage in the heavy parts. The shrinkage of aluminum requires a great deal of precaution on some heavy types of patterns. The cracking of aluminum castings in cooling is often caused by the presence of zinc in the mixture.

I explain in the following pages the methods I used with the best success in this work.

MAKING A PLATE

After having your master patterns cleaned and in good drawing condition, set them on a straight board and wedge them up in the position which they should be when cast on the plate, as in figure I. If you have a gate to ram up with the patterns, place it in the proper position as in Figure I, then determine how high the cope half of the pattern should extend above the joint of the mould. If it should be one inch, for example, cut some pieces of wood one inch thick, and place them under the edges of the flask as in Figure I. You are now prepared to ram the mould. I find a medium fine grade of sand very satisfactory for this work. Work your sand as dry as possible, as it is necessary to ram the drag half of the mould hard enough to withstand the ramming of the cope. If the drag is rammed too soft, you will ram the parting too low in places when ramming the cope, and will more than likely get a very untrue surface. Ordinarily this work does not require venting. Be very careful to rub bottom board on firmly, and use clamps to roll over. Rub flask to a good seat on the floor before removing clamps, as you are in danger of changing the position of patterns when ramming the cope if you have left play in the bottom board. After removing

the follow board, you will have sand extending above the joint of the flask the same thickness as the blocks which you used to jump the drag. This sand should be struck off with a true straight edge, only leaving sufficient sand around patterns to form the proper parting. Great care should be taken in making the parting, as a slight mistake in same will cull the plate. After making the parting as near perfect as possible, rap the pattern slightly, and start to draw each one. It is not necessary to draw the patterns, but barely raise them, as this will show you whether you have parted low enough to allow them to draw freely. It may be well to add at this time that in drawing the pattern, a screw should be used, as in pounding in a draw plug, it is possible to rock the pattern in the mould, or to pound it down if the plug does not take hold readily. After you have ascertained that the parting is correct, tool the mould as smoothly as possible. Then dust parting lightly over the drag. We are now in position to ram the cope. See that the cope is stiff and barred close enough to prevent any sagging after the mould is complete, as you will remember that the mould has no bearing in the center. The flask should have four pins and they should stand perfectly at right angles with the

joint of the flask. Now set the sprue and ram the cope. It will not be necessary to ram the cope hard if it is properly barred. When setting the sprue, have in mind the fact that the plate will take up considerable space, and set the sprue where it will allow sufficient space for cutting gates. If you experience any difficulty in securing a good cope, examine the patterns carefully, as this is fairly good evidence that some change is necessary. It may be the lack of proper draft on the patterns and again it is possible that the patterns are not set properly in the mould. In cases where the patterns have good draft with the exception of one straight side, it may be necessary to tip the patterns slightly so as to equalize the draft and favor this straight side. If you find that the patterns would cope to a better advantage when tipped a trifle, do not try to tip them in the drag, but shake the drag out and set the patterns up properly and ram a new drag. In changing the position of the pattern after the drag is rammed, you are in danger of losing the true shape of the pattern. Another point which should be brought to your attention is the fact that you would certainly experience difficulty in getting a good cope off the plate with the use of a snap flask, when you are unable to get a good lift with

FIG. III.
Cope and drag rammed.

the use of a barred flask and careful attention in ramming. I have always considered that it is far more profitable to shake out a mould when you find that it can be improved upon, than to cast a plate from it and have it a source of trouble as long as it is in use. After you have succeeded in getting a good cope you are safe to finish the mould, for you know that the patterns will draw as you have tried them before ramming the cope. I invariably build in the plate before drawing the patterns for the reason that sand may fall in the mould when making the plate, and if the patterns are not drawn, the dirt may be blown out without danger of disfiguring the mould, while if the patterns were drawn you would in many cases be unable to use the bellows for fear of loosening corners or upsetting small cores, and in using tools to clean dirt from the mould you are more than likely to do some damage.

FORMING THE PLATE

To form the plate you will use frames lettered A and B, as in Figure IV. Frame A will be used on the joint of the flask, and should be the same thickness as you require in the plate which is usually three-eighths of an inch, although in some cases

the thickness varies somewhat. A plate less than three-eighths of an inch is more or less fragile, and I consider that a three-eighths inch plate feeds the patterns to the best advantage when the casting is shrinking. In some heavy classes of work, a plate seven-sixteenths or one-half inch thick will give the most satisfaction. Judgment will have to be used in this matter. Be certain that all dirt is brushed from the joint of flask before placing frame on joint, as in Figure V. After you have placed the frame lettered A on joint of flask, the frame lettered B should be placed on the mould in such a manner as to have patterns centrally located on plate. The frame lettered B will be of the same thickness as the frame lettered A, and one-half or five-eighths of an inch will be sufficiently wide for this frame, for if this frame is made unnecessarily wide, it may interfere with the patterns or the parting line of the mould. The frame B will be of the same dimensions as the flask in connection with which it is to be used plus enough on the ends to allow for pin attachments or moulding machine appliances such as drawing devices, etc. A lug will also be necessary on one corner to provide for attaching of the vibrator. The plate I show in these illustrations is what is known as a slip-out

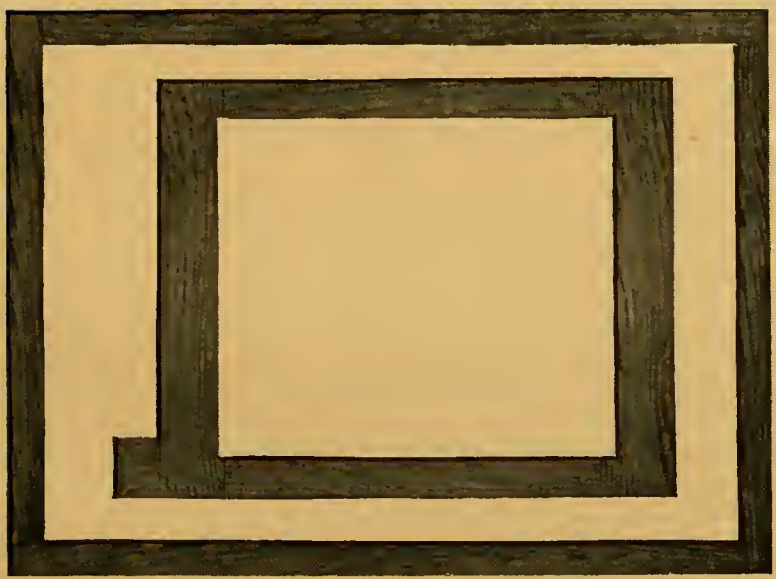


FIG. IV.

Frames used in forming plate.
The large frame will be known as Frame A, and the small frame will be known as Frame B.

plate, and is used on round pins, therefore the pin holes may be drilled to the best advantage, although when made for flask pins that are other than round, it is advisable to cast these holes in the plate. After the frames are in the proper position, lay weights of some kind on them to hold them in place while filling the space between the frames with sand. It is sufficient to press this sand in with the hands as you are making a foreign joint, and it should be soft enough to allow the cope to press into it without crushing in places where the cope may present an uneven surface. The impression which is left in the drag by the sprue will be covered over by the new parting, therefore it is advisable to press a nail into this impression for a guide in cutting the gates. The parting between the frames should be destroyed before building in this sand, so as to make the sand adhere to the sand in the drag, otherwise you would be unable to blow dirt from the mould without disturbing this new parting. It is not practical to have a set rule for gating these plate castings any more so than an ordinary foundry practice. When patterns which have heavy parts are being made on a plate, these heavy parts are likely to shrink. To overcome this, use a large gate pin and cut the gates sufficiently heavy to

allow the metal in the gates to remain fluid for as long a period as the metal in the plate casting. When the gates are arranged in this manner, see that you have a piece of iron near at hand which is a little larger in diameter than the sprue. A butt rammer can often be used. After the casting has been poured use this piece of iron to exert a pressure on the sprue. This will aid greatly to reduce the shrinkage. Patterns which are in proportion with the plate will not cause trouble in shrinking if the mixture of metal is right. The aluminum should never be poured when too hot, as a perfectly good mould will yield a poor casting if poured when the metal is too hot. Stir the metal in the pot with an iron rod, and skim the metal until it is clean. If the metal barely sticks to the hot rod, it is at the best heat for casting. A plate which is made properly will require very little scraping. It is usually well to scrape the parts which have little draft, the remainder of the plate can be cleaned sufficiently well with a wire scratch brush.

IRON PLATES

If at any time you have occasion to make a plate of this kind in iron, use an iron flask and make a dry sand mould. Make

FIG. V.

Frames in place and sand filled in to form plate.

the mould in the same manner as described previously, and place it in the oven to dry. The time spent by the pattern maker in cleaning and preparing a cast iron plate for moulding, will more than offset the difference in the cost of the metal. An iron plate is also much more heavy to handle in the foundry, and will not be handled as rapidly by the moulder as an aluminum plate. This match plate idea is an old one, but it never became popular among foundrymen until they learned the value of aluminum in this work.

SPLIT PATTERNS

The best method of handling split patterns in plate work is by riveting the patterns to a metal plate, or when a wood plate is used the patterns may be screwed to the plate. It is a good plan to have a few wood plates in stock. These plates can be made about one and one fourth inches thick and constructed in such a manner that they will remain true. A piece of one-eighth inch band iron can be bent at right angles and screwed to the plate so as to protect the corners. Thin plates may be cast to fit the snap flask pins and screwed to the plate. A plate of this kind will be found very serviceable for mounting flatbacks or

split patterns which are not to be used for a great length of time. Ordinarily a few brads will be sufficient to hold these patterns to the plate, and after the order is filled these patterns can easily be taken off the plate. In this way the same plate will answer for many different patterns, thus eliminating unnecessary expense in making plates for patterns which are only used for one run of castings. I would not advise you to make a plate like the above for work that is standard. Split patterns, or patterns which have a flat cope, should be riveted to a metal plate when they are to be used for any great length of time. A cylindrical pattern or bushing pattern to be cast on end, and having core prints on both ends, can be attached to a plate in the following manner. Make the cope print on the pattern straight for the thickness of the plate, then give the remainder of the print the proper taper. For example, if the plate is three-eights of an inch thick and you require one inch for core print, the print on the pattern will be one and three-eighths inches long. The print will be turned without taper for three-eights of an inch and the remaining inch of print will have the required taper. If there are a number of patterns to be placed on the plate, lay out the center of each pattern

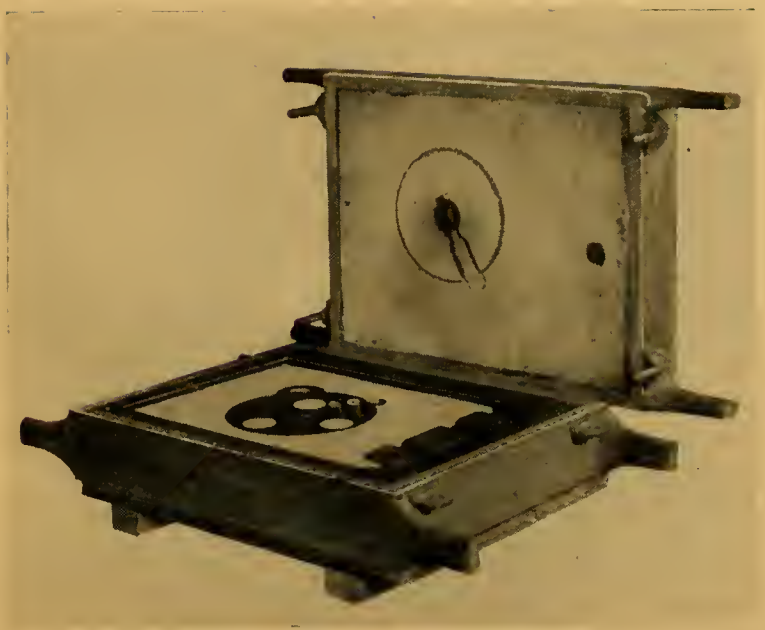


FIG. VI.
Mould finished and ready to close.

and punch these centers for drilling. These holes should be drilled the same size, as the core print and the print will be driven through the hole, and in this way the three-eighths of an inch of print which you have turned straight will fill the hole in the plate and the remaining inch of taper print will project through the plate and form the cope print. Patterns located in this way are certain to match accurately and will not become shifted on the plate. In making the core box, it will be necessary to subtract the thickness of the plate from the length which the pattern calipers. Patterns which are flat on the cope side, and are all in the drag, should simply be located on the plate so as to facilitate the best method of gating, and riveted securely to the plate. Brass or copper rivets are preferable, as steel rivets coat heavily with rust. A simple system of matching split patterns is as follows. Set half of the pattern on parallels with the joint of the pattern resting on the parallels, and drill one hole at each end of the pattern, then match the two halves perfectly and set the pattern on the drill press table with the joint level and finish drilling the hole through the lower half of the pattern. These holes should now be reamed for a driving fit for straight pins. You can now locate one half

of the pattern on the plate and drill the plate through the holes in the pattern. After pinning half the pattern to each side of the plate through these drilled holes, you have the pattern matched and held securely in place. You can now drill for the remainder of the rivets. A gate should be riveted securely in place and you will have a plate which will not only mould well, but will also be durable. A variety of materials may be used for these plates such as iron, steel and aluminum. Aluminum is preferable as it is light and will not rust. Sheet aluminum can be purchased for this work, or these plates can be cast from a wood pattern of the proper dimensions. If care is taken in moulding, they can be made fairly true and a few brushes of the file will place them in condition to receive patterns. When casting these plates, it is possible to cast them to size and have vibrator lug and pin lugs cast on the plate. In this way you save the patternmaker the time of cutting a plate from the solid sheet of metal. If steel plates are used, I should prefer to purchase accurately ground plates which are on the market for this class of work. On many patterns and core boxes, it is necessary to have loose pieces which are preferably dovetailed to the pattern. I discovered a very good way to handle this

FIG. VII.
The finished plate.

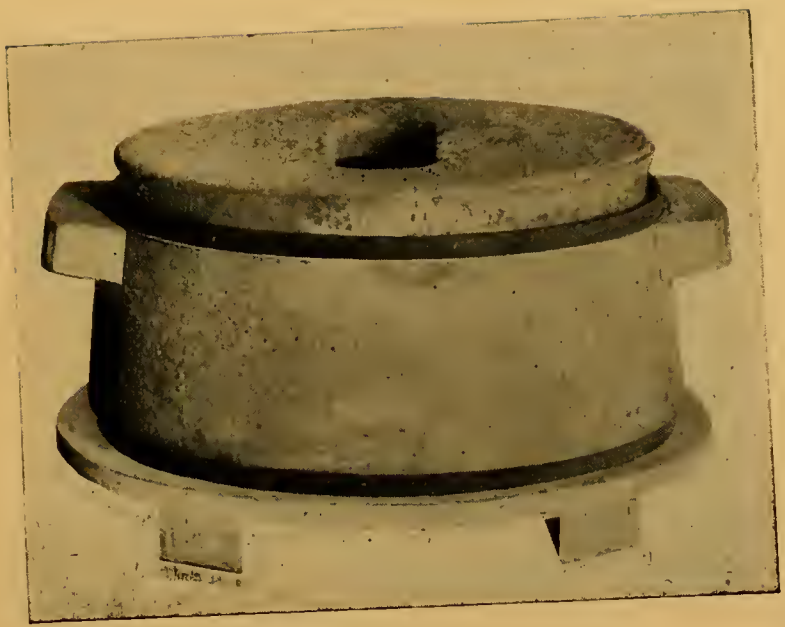
A round snap flask which is removed from the mould in the same manner as a jacket.
A-I.

dovetail job a few years ago, and I sincerely believe that I have saved many dollars in pattern labor by using this method. Have the wood pattern made in the usual way, with the loose piece dovetailed in place. Cast the loose piece in brass, and fit this brass piece to the wood pattern. It may require shimming up, as the shrinkage in casting may make it loose if it is very large. Now ram the pattern up with the brass pieces in place. After drawing the wood pattern, remove the shimming and be careful not to disturb the brass pieces as they are to remain in the mould. Pour the casting and when cool, knock the brass pieces out and you will have a perfect fitting dovetail. The loose pieces should be brass, for if made in aluminum they may fuse to the casting, which would make it impossible to remove them.

SNAP FLASKS

The old type of straight snap flask is being rapidly replaced by the tapered snap flask. It is amazing to see how much scrap can be saved in many instances by changing from the old straight snap flask to the tapered snap flask, as a tapered snap flask practically eliminates crushes and runouts providing the jackets are a fairly good fit.

Although in taper snap moulding there are points which require careful attention, as in everything of any importance. A point that I shall bring to your attention at this time is the importance of having the cope and drag match properly. Often in adjusting the flask pins, the cope may be shifted to one side or the other and a mould made from this flask will show an offset, as the cope half of the mould will not be directly over the drag half of the mould. Castings made in this mould would be accurate enough if the mould could be poured without a jacket, but in pressing a jacket down over a mould the cope half of the mould will shift over to match with the drag half of the mould, thus causing a shift in the casting. This does not occur in straight snap moulding, as a straight jacket shaves the sides of the mould, and an offset of this kind will be shaved off when the jacket is pressed down over the mould. In ordering snap flasks for standard work, save all the sand possible. A round casting should not be made in a square flask any more so than a square casting should be made in a round flask. Cast-iron jackets are a paying proposition in taper snap work, and the new adjustable jacket which is on the market has many good points.



Flywheel mould ready for pouring.
A-III.

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